Pregnancy outcome variables and associated factors in different nationalities living in Kuwait

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الاختلافات في نتائج الحمل ومنبئاته بين الجنسيات المختلفة المقيمة في الكويت

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الخلاصة: تمثل الهدف من هذه الدراسة في التحقيق في الاختلافات القائمة في نتائج الحمل بين الجنسيات المختلفة المقيمة في الكويت. وقد جُمعت بيانات مقطعية من 369 زوجاً من الأمهات والمواليد عند الولادة تتعلق بطول الأم، وهيموجلوبين الأم، وهيموجلوبين الطفل، ومحيط العضد، والعمر الولادي، ووزن المشيمة، والوزن عند الميلاد، وطول الجنين من تاج الرأس إلى كعب القدم، ومحيط الرأس. ولوحظت اختلافات كبيرة بين الجنسيات المختلفة في كل من هيموجلوبين الأم ومحيط رأس الجنين ووزن المشيمة والوزن عند الميلاد وطول الأم. وتتسم النساء الكويتيات والهنديات بانخفاض وزن المشيمة ويتسم مواليدهم بانخفاض محيط الرأس وانخفاض الطول من تاج الرأس إلى كعب القدم. وتراوح معدل انتشار فقر الدم (هيموجلوبين 11> 0 جرام/ ديسيلتر) بين 7.1 ٪ (بين اللبنانيات) و30.0 ٪ (بين الكويتيات) مع معدل انتشار كلي بلغ 19.5 ٪. وبلغ معدل انتشار انخفاض وزن المواليد 3.5 ٪. وكشف تحليل انحدار خطي متعدد عن وزن المشيمة باعتباره منبئاً مهماً للوزن عند الميلاد وطول الجنين من تاج الرأس إلى كعب القدم ومحيط الرأس. ويستلزم احتساب أهمية هذه الاختلافات والعوامل المساهمة فيها إجراء مزيد من البحث بشأنها.

ABSTRACT This study aimed to investigate differences in pregnancy outcome among various nationalities residing in Kuwait. Cross-sectional data were collected from 369 mother–infant dyads at delivery on mother height (MH), mother haemoglobin (mHb), child haemoglobin (cHb), mid-upper arm circumference (MUAC), gestational age (GA), placental weight (PW), birth weight (BW), crown–heal length (CHL), and head circumference (HC). Significant differences among various nationalities were observed in mHb, HC, CHL, PW and MH. Kuwaiti and Indian women had lower PW and their babies had lower HC and CHL. Prevalence of anaemia (Hb <11.0 g/dL) ranged from 7.1% (Lebanese) to 30.0% (Kuwaiti) with the overall prevalence of 19.5%. Prevalence of low birth weight was 3.5%. Multiple linear regression analysis revealed PW as a significant predictor of BW, CHL and HC. Significant differences among various nationalities were observed in mHb, HC, CHL, PW and MH.The significance of these differences and their contributing factors needs further research.

Différences en matière d'issues de grossesse et leurs prédicteurs entre les diverses nationalités résidant au Koweït

RÉSUMÉ La présente étude visait à analyser les différences en matière d'issue de grossesse entre les différentes nationalités résidant au Koweït. Des données transversales ont été recueillies auprès de 369 dyades mère-nouveau-né au moment de l'accouchement sur la taille de la mère, l'hémoglobine (Hb) maternelle, l'hémoglobine de l'enfant (Hbe), le périmètre brachial (PB), l'âge gestationnel, le poids du placenta (PP), le poids de naissance (PN), la taille vertex-talon (TVT), et le périmètre crânien (PC). Des différences significatives ont été observées entre les diverses nationalités en ce qui concerne l'Hb maternelle, le PC, le LVT, le PP et la taille de la mère. Les femmes koweïtiennes et indiennes présentaient un PP plus faible et leurs bébés avaient un PC et une TVT inférieures. La prévalence de l'anémie (Hb <11,0 g/dL) était comprise entre 7,1 % (Libanaises) et 30,0 % (Koweïtiennes) avec une prévalence globale de 19,5 %. La prévalence du faible poids de naissance était de 3,5 %. L'analyse de régression linéaire multiple a révélé que le PP constituait un facteur prédictif pour le PN, la LVT et le PC. Des différences significatives ont été observées entre les diverses nationalités en termes d'Hb maternelle, de PC, de LVT, de PP et de taille de la mère. L'importance de ces différences et les facteurs qui y contribuent nécessitent des recherches supplémentaires.

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Introduction

Normal pregnancy outcome is important for the normal development, health and well-being of the newborn. The current hypothesis on the fetal origin of later-life chronic diseases suggests that exposure of the fetus to an adverse environment, including malnutrition, predisposes a person to later life chronic diseases, such as cardiovascular diseases, hypertension, diabetes and obesity (*1,2*). Birth weight is one of the most important predictors of fetal survival and health. Children born with low birth weight are at increased risk of death in the first year of life compared with children born with normal birth weight. In the United States of America (USA), infants with low birth weight make up 8% of all births, yet they represent more than 60% of all infant deaths (*3*).

Although the incidence of low birth weight in Kuwait is low, ranging from 3.4% to 4.5% of births (*4,5*), a significant increase in poor pregnancy outcomes including stillbirth, low birth weight and macrosomia has been reported recently(*6*). In addition, differences in birth weights between the main ethnic groups in Kuwait have been reported (*7,8*). Kuwait is a multiethnic society and two thirds of the population are expatriates of various nationalities. The current population of Kuwait is 4.16 million, of which 1.35 million (30.4%) are Kuwaitis and 3.09 million (69.6%) are non-Kuwaitis (*9*). According to the 2011 population census, people from South Asia (34%) and other Arab countries (21%) make up most of the non-Kuwaiti population. The main nationalities in Kuwait are Indian and Egyptian (*10*).

Studying the relationship between placental factors and pregnancy outcomes such as birth weight, fetal malnutrition and anaemia has gained considerable interest in recent years (*11*). The birth weight of a baby depends not only on the mother's nutrition but also on the placenta's ability to transport nutrients to it from its mother (*2*). Placental weight and volume can predict pregnancy outcome and thus the future health of the newborn (*12–14*). For example, placental size and shape has been reported to predict blood pressure at age 9 years (*15*). Thus, the shape and size of the placenta at birth has become a new marker for pregnancy outcome and for chronic disease in later life (*2*). It has been reported that placental characteristics are not only influenced by neonatal, nutritional and environmental factors (*16–18*), but also by ethnicity (*19–21*). It is therefore, important to study the influence of ethnicity on placental parameters as well as other variables associated with pregnancy outcome.

The multiethnic society in Kuwait provides an opportunity to study differences between nationalities in pregnancy and pregnancy outcome variables. The aim of this study therefore was to investigate differences between various nationalities living in Kuwait in maternal and pregnancy variables, including placental weight, and infant-related birth characteristics. We also evaluated the predictive value of placental weight on various pregnancy outcome variables.

Methods

Study design and setting

We conducted a cross-sectional study at the Al-Sabah Maternity Hospital, Kuwait. This is the only specialized maternity hospital in Kuwait, with about 12 000 deliveries a year, which represents one third of all deliveries in the country.

Sample size and study participants

To detect a minimum difference of 0.3 between proportions of mothers with anaemia of any of 2 nationalities, and assuming a prevalence of anaemia of 30% in one of the ethnic groups, an alpha value of 0.05 and study power of ≥ 0.95, we needed a sample of at least 65 mothers in each nationality.

Women who were admitted to the hospital and delivered their baby between 07:00 and 19:00 over a period of 3 months in 2011 were recruited into the study. Night deliveries were not included in the study because of restricted access to the hospital at night. Eligible participants were women who had been resident in Kuwait for at least 1 year. Women with multiple pregnancies, gestational diabetes, and those diagnosed with hypertension and other cardiovascular diseases were excluded from the study.

Data collection

Maternal interviews and measurements were conducted either before or after delivery depending on the mother's condition. Information on nationality, length of stay in Kuwait (in case of non-Kuwaiti nationals), number of children and parity were obtained from the women during the interview. Data on mother's height and age, mid-upper arm circumference and gestational age were obtained from the medical records. After delivery, birth weight of each neonate was recorded to the nearest 10 g, and crown to heel length and head circumference were measured to the nearest 0.1 cm, using non-stretchable tape. Placental weight was obtained by weighing the placenta after draining all the blood. The haemoglobin (Hb) levels of the child (cHb) and the mother (mHb) are routinely measured at delivery and admittance respectively at the hospital laboratory, and these data were obtained from the hospital records. Placental weight to birth weight ratio was also calculated.

Statistical analyses

Data were analysed with *SPSS* for Windows, version 21. Data are expressed as mean and standard deviation (SD) as appropriate. One way analysis of variance with Bonferroni correction, as post

hoc analysis, was used to estimate mean differences. Simple and multiple regression analyses were performed to test the significance of associations. The prevalence of anaemia, defined as Hb < 11.0 g/dL (*22*), in the different nationalities was compared with the chi-squared test. The level of significance was set at $P < 0.05$.

Ethical considerations

The study was conducted according to the guidelines laid down in the Declaration of Helsinki and the study protocol was approved by the Ministry of Health of the State of Kuwait. Written informed consent was obtained from all the participants.

Results

A total of 369 mother-baby pairs were included in the study: 80 (22%) were Kuwaitis, 81 (22%) Egyptians, 45 (12%) Indians, 42 (11%) Syrians, 28 (6%) Lebanese and 93 (25%) other nationalities. The other nationalities included Iranians, Pakistanis, Jordanians and Filipinos; the individual numbers in these nationalities were not enough to conduct meaningful statistical analysis.

The maternal and pregnancy outcome variables (mean and SD) according to nationality are shown in Table 1. Analysis of variance showed significant difference between the nationalities in mHb ($P = 0.001$), head circumference ($P = 0.011$), crown-heel length ($P = 0.039$), placental weight ($P = 0.002$), maternal height ($P < 0.001$) and maternal age ($P < 0.0001$). On the other hand, there were no significant differences between the nationalities in birth weight ($P = 0.423$), cHb ($P = 0.337$), placental weight/birth weight ratio ($P = 0.352$), gestational age ($P = 0.283$) and mid-upper arm circumference ($P = 0.330$).

The Bonferroni post-hoc analysis showed that Syrian women with a mean age of 26.4 (SD 5.3) years were significantly younger than Kuwaiti and Indian women. Indian women (mean height = 154.6, SD 14.7 cm) were significantly shorter than the other nationalities. Kuwaiti and Indian women had significantly lower mean placental weight [629.9 (SD 78) g and 629.5 (SD 92) g respectively] than Lebanese women [695.5 (SD 100) g]. In addition, babies born to Indian women had significantly lower head circumference compared to Kuwaiti women but not to the other nationalities. Crown-heel length was not significantly different between the different nationalities. Mean mHb levels in Kuwaiti women were significantly lower than Egyptian and Indian women but not compared with other nationalities.

The overall prevalence of anaemia (Hb < 11.0 g/dL) in the 369 mother–baby pairs was 19.5%. Although there were wide variations in the prevalence of anaemia between the various nationalities, ranging from 7.1% in Lebanese women to 30.3% in Kuwaiti women (Table 2), the differences were not statistically significant ($P = 0.057$). There were no significant differences in birth weight between the nationalities. The overall prevalence of low birth weight (defined as birth weight < 2 500 g) was 3.5%.

Multiple regression analysis (Table 3) showed that placental weight was a significant predictor of birth weight ($P < 0.001$), crown-heel length ($P < 0.001$) and head circumference ($P = 0.004$). In addition, maternal height was a significant predictor of birth weight ($P = 0.044$) and crown-heel length ($P = 0.04$), after adjusting for various confounding variables. Gestational age was the only predictor of placental weight ($P = 0.013$). The placental weight/birth weight ratio was not a significant predictor of any of the pregnancy outcome variables (data not shown).

Table 1 Mean (standard deviation) values of maternal and pregnancy outcome variables in the various nationalities

Nationality (*n*)	Mother's age (years)	mHb (g/dL)	cHb (g/dL)	HC (cm)	CHL (cm)	PW (g)	MH (cm)	GA (days)	BW (g)	MUAC (cm)	PW/WB ratio
Kuwaiti (80)	29.6 (5.5)^{a}	11.55 (1.44)^{a}	14.91 (1.28)	33.9 (1.3)^{ab}	49.6 (2.6)	629.9 (78.1)^{a}	160.1 (4.7)^{a}	274.4 (10.8)	3.17 (0.36)	29.7 (3.4)	0.20 (0.04)
Egyptian (81)	27.3 (5.0)^{ab}	12.29 (1.16)^{b}	14.93 (1.52)	34.7 (2.8)^{a}	50.7 (2.7)	663.3 (77.9)^{ab}	162.7 (6.0)^{a}	277.4 (8.4)	3.43 (0.42)	29.8 (3.5)	0.20 (0.03)
Indian (45)	29.9 (5.5)^{a}	12.42 (1.24)^{b}	15.34 (1.50)	33.2 (4.3)^{b}	49.9 (3.7)	629.5 (92.0)^{a}	154.6 (14.7)^{b}	275.1 (8.6)	3.78 (4.34)	28.5 (3.1)	0.19 (0.05)
Syrian (42)	26.4 (5.3)^{b}	12.16 (1.27)^{ab}	15.35 (1.66)	34.3 (0.9)^{ab}	50.1 (2.3)	666.1 (70.4)^{ab}	163.9 (6.5)^{a}	277.5 (7.8)	3.38 (0.39)	30.1 (3.7)	0.20 (0.02)
Lebanese (29)	26.6 (5.0)^{ab}	12.41 (2.03)^{ab}	14.78 (1.70)	34.3 (1.4)^{ab}	50.1 (4.3)	695.5 (100.1)^{b}	162.2 (6.1)^{a}	276.0 (8.6)	3.43 (0.53)	29.3 (4.0)	0.19 (0.04)

Analysis of variance showed significant difference between the nationalities in mHb ($P = 0.001$), head circumference ($P = 0.011$), crown–heel length ($P = 0.039$), placental weight ($P = 0.002$), maternal height ($P < 0.001$) and maternal age ($P < 0.0001$).

Values with different superscripts within the same column differ significantly ($P < 0.05$) as assessed by Bonferroni post-hoc analysis.

mHb = mother haemoglobin, cHb = child haemoglobin, HC = head circumference, CHL = crown–heal length, PW = placental weight, MH = mother height, GA = gestational age, BW = birth weight, MUAC = mid-upper arm circumference.

Table 2 Prevalence of anemia in various nationalities

Nationality	Total number	Number with anaemia (HB < 11 g/dL)	%
Kuwaiti	80	24	30
Egyptian	81	11	14
Indian	45	7	16
Syrian	42	9	21
Lebanese	28	2	7

Chi-squared = 10.7 (df = 5); P = 0.057.

Discussion

The overall prevalence of low birth weight in this sample was 3.5%, which is comparable to the previously reported prevalence of low birth weight in Kuwait (*4,5*). However, we did not find a significant difference in birth weight between the nationalities studied, in contrast to previously reported studies on birth weight among various ethnic groups in Kuwait (*7,8*). Our smaller sample size compared with these studies could have resulted in this lack of statistical significance.

Another significant finding in our study was the very high prevalence of anaemia (30%) in Kuwaiti pregnant women. Several studies have shown that anaemia is a significant public health problem in Kuwait (*23–25*). Previous studies from Kuwait reported that 28.7-36.8% of pregnant Kuwaiti women were anaemic (*25,26*) and our results agree with these reports. Differences in the dietary pattern between nationalities could be the reason for the difference in the prevalence of anaemia. Although we do not have information about the dietary pattern of this sample, a previous study reported that a large proportion of Kuwaiti pregnant women had not eaten iron-rich foods like beef (62.4%), goat or lamb (45.2%), fish (54.6%), liver (87.3%) and white bread (which is fortified with iron and some B vitamins as required by law) (74%) at all during the week preceding the interview (*25*). In addition, the consumption of tea and coffee, which are known to interfere with iron absorption, was high in this group.

We found significant differences between the nationalities in placental weight and head circumference. Kuwaiti and Indian women had significantly lower placental weight compared with Lebanese women, and babies born to Indian women had significantly lower head circumference compared with Egyptian women, suggesting the predictive importance of placental weight to pregnancy outcome in Indian women. In a previous study, the placental weight of Indian women was reported to be significantly lower than that of Malay and Chinese women (*11*). Similarly,

Table 3 Predictors of pregnancy outcome variables in multiple linear regression analyses

Dependent variable	Predictors in the final model	Regression coefficient (β)	95% confidence interval	*P*-value	R^2
BW (kg) Model 1	Constant	0.766	–	–	0.402
	PW (g)	0.003	0.002 to 0.003	< 0.001	
	MH (cm)	0.556	0.015 to 1.096	0.044	
	Sex	0.157	0.054 to 0.259	0.003	
HC (cm) Model 2	Constant	36.731	–	–	0.132
	PW (g)	0.005	0.002 to 0.008	0.004	
	MUAC (cm)	–0.143	–0.231 to –0.055	0.002	
	Sex	0.972	0.370 to 1.573	0.002	
CHL (cm) Model 3	Constant	36.541	–	–	0.171
	PW (g)	0.011	0.006 to 0.016	< 0.001	
	Hb (g/dL)	–0.315	–0.624 to –0.005	0.046	
	MH (cm)	0.051	0.002 to 0.009	0.040	
	Sex	1.550	0.629 to 2.471	0.001	
PW (g) Model 4	Constant	64.330	–	–	0.223
	GA	2.136	1.236 to 3.036	< 0.001	

BW = birth weight, HC = head circumference, CHL = crown-heel length, PW = placental weight, MH = mother height, MUAC = mid-upper arm circumference, mHb = mother haemoglobin, cHb = child haemoglobin, GA = gestational age.

lower placental weight has been reported previously in Asian women compared with European and Afro-Caribbean women (*27*). Several other studies have reported that placental characteristics differ between different ethnic groups (*27–29*). When adjusted for other confounding variable in the regression analysis, placental weight was a significant predictor of birth weight, crown-heel length and head circumference. Other studies have also shown that placental weight was a predictor of birth weight (*11–15*), neonatal length and head circumference (*11*).

Several studies have suggested that the placental weight/birth weight ratio is a useful marker for pregnancy outcome (*30,31*). It has been suggested that the combination of a large placenta and low birth weight is a strong independent risk factor for cardiovascular disease in adulthood (*32*). However, in our study, the placental weight/birth weight ratio was not a significant predictor of any of the birth outcomes (birth weight, head circumference, crown-heel length). Similar to our findings, other studies have also found that the placental weight/birth weight ratio is not a consistent predictor of pregnancy outcome (*27–29*).

Our study has several limitations. First, we used a convenience sampling approach for logistic reasons, and collected our sample only during the day time (07:00 to 19:00), as our access to the hospital during the night was restricted. However, not including deliveries that occurred at night is unlikely to affect the representativeness of our sample of the general population. Second, the length of residence in Kuwait for the non-Kuwaiti participants was not included in the analysis, which, although unlikely, could have confounded the results. Third, we did not collect data on the nutritional status of the women or their socioeconomic status, which could be potential confounding factors. One of the main predictors of fetal growth is the weight gain during pregnancy. As this was a cross-sectional study and data were collected only at the time of delivery, information on weight gained during pregnancy could not be obtained. Therefore, a prospective longitudinal study in which women are followed throughout pregnancy until delivery would provide more robust data on the various factors which could have a confounding effect on the pregnancy outcome variables.

Conclusion

Our study found significant differences in head circumference between different nationalities living in Kuwait and these differences were predicted by placental weight. Further research is needed to elucidate the significance of these differences in pregnancy outcome and factors that contribute to these differences.

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